CHAPTER EIGHT: UNDERGROUND WATER STORAGE, SAVINGS AND REPLENISHMENT

8.1 INTRODUCTION

The purpose of the Underground Water Storage, Savings & Replenishment (Recharge) Program is to encourage the development, delivery, use, and storage of renewable water supplies now and in the future. The Recharge Program, in combination with *Fourth Management Plan for the Pinal Active Management Area* (4MP) conservation program efforts, is intended to support achievement of the water management goal for the Pinal Active Management Area (PAMA). Increasing the use of renewable water supplies, particularly Central Arizona Project (CAP) water and reclaimed[1] water in lieu of groundwater, is a key component to preserving groundwater supplies for future non-irrigation uses.

For the purposes of this chapter, "augmentation" means increasing the availability and use of renewable water supplies such as CAP water and reclaimed water in lieu of groundwater. "Recharge" means storage of excess water (non-groundwater) supplies for future use pursuant to the Underground Water Storage, Savings and Replenishment Act (A.R.S. § 45-801.01, *et seq*). Although the Arizona Department of Water Resources (ADWR) does not have the ability to implement an augmentation program, ADWR recognizes the need to continue to pursue and obtain additional water supplies into the future.

Although achieving the PAMA groundwater management goal of preserving the agricultural economy for as long as feasible while preserving future water supplies for future uses remains ADWR's primary objective, the objectives of the Recharge Program in the fourth management period serve to enhance water resource management on a localized sub-PAMA scale. The 4MP recognizes these local challenges, taking these site-specific areas into consideration, and proposes possible solutions that can assist local stakeholders in addressing these challenges.

8.2 THE RECHARGE PROGRAM

The augmentation and recharge of renewable water resources is a principal mechanism by which the PAMA can preserve future water supplies for non-irrigation uses and meet site-specific goals. During the fourth management period, ADWR will continue to encourage the development, efficient use, and recharge of renewable water supplies for the PAMA. Additionally, the Recharge Program is an effective tool to mitigate local water supply problems, depending where storage and recovery activities occur.

Recharge is an important water management tool in the PAMA 4MP. While the development and direct use of renewable water supplies is an important component of PAMA water management during the fourth management period, underground water storage provides a cost-effective means of utilizing available renewable water supplies that cannot currently be used directly.

8.2.1 Overview of Recharge and Recovery

Recharge statutes and 4MP provisions provide regulatory framework in which water may be stored and recovered. The statutes and the PAMA 4MP, when read together, establish a number of objectives. These objectives include:

- To protect the general economy and welfare of the state by encouraging the use of renewable water supplies instead of groundwater, through a flexible and effective regulatory program for the underground storage, savings, and replenishment of water;

[1] In the PAMA 4MP, the term "reclaimed water" has the same definition as effluent in A.R.S. § 45-101.

- To allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of renewable water instead of constructing renewable water treatment plants and pipeline distribution systems;
- To reduce overdraft and achieve the management goals of the Active Management Areas (AMAs);
- To store water underground for use during seasonal peak demand periods and for use during periods of shortage;
- To augment the local water supply to allow future growth and development.

Since the inception of the recharge and recovery program in Arizona in 1986, recharge and recovery have become increasingly flexible over time with regard to storage and recovery locations and the number and types of programs available. With the increased flexibility have come increased complexity and local water challenges. High or low water tables, water quality, physical availability, and third party impacts are all challenges that can be affected positively or negatively by recharge and recovery facilities. Thus, the regulation of the program to maximize benefits and minimize harm is crucial to an effective program.

8.2.2 Primary Program Components

There are several key components of recharge and recovery. Rights to recover water may be exercised annually or long-term. Any recoverable water can be recovered within the same year in which it was stored. Stored water may also be credited to a long-term storage account, which allows the account holder to recover the water at any point in the future, if certain conditions are met. These conditions assist the achievement of water management goals by minimizing the potential negative impacts. The definition of "Water that cannot reasonably be used directly" contained A.R.S. § 45-802.01(22) limits the types of stored water for which long-term storage credits may be earned.

No time limit exists on the right to recover long-term storage credits. Long-term storage credits may be assigned to another person if that person can meet the same provisions for earning credits as the storer. In addition, once the water is recovered, it retains the same legal characteristics it had before storage.

The Underground Water Storage (UWS) Program is also the mechanism by which the Central Arizona Groundwater Replenishment District (CAGRD) replenishes water on behalf of its members. The CAGRD may store water and accrue long-term storage credits or obtain credits already accrued. The CAGRD can request that ADWR transfer credits from the CAGRD's long-term storage account to its replenishment account, termed a "conservation district account" by statute, to offset the CAGRD replenishment obligations. A.R.S. § 45-859.01. Once the credits are transferred to the replenishment account, they may not be recovered, assigned, or moved back to the long-term storage account.

Finally, in many cases, a certain percentage of the volume of water stored is made non-recoverable by statute to benefit the aquifer. These required non-recoverable volumes are called "cuts to the aquifer." The cuts apply to the storage of certain types of water for long-term storage credits. They do not apply to water that is stored and recovered annually. In the PAMA, cuts to the aquifer totaled more than 137,800 ac-ft between 1986 and 2014 from storage of reclaimed water at managed facilities[2], and CAP water stored at Groundwater Savings Facilities (GSFs)[3].

[2] "Managed underground storage facility means a facility . . . that is designed and managed to utilize the natural channel of a stream to store water underground pursuant to permits issued under this chapter through artificial and controlled release of water other than surface water naturally present in the stream" A.R.S. § 45-802.01(12).

[3] "Groundwater savings facility means a facility . . . in an active management area or an irrigation non-expansion area at which groundwater withdrawals are eliminated or reduced by recipients who use in-lieu water on a gallon-for-gallon substitute basis for groundwater that otherwise would have been pumped from within that active management area or irrigation non-expansion area." A.R.S. § 45-802.01(8).

Persons who elect to undertake recharge-related activities must obtain the necessary permits from ADWR. There are three recharge-related permit categories: (1) storage facility permits, composed of constructed or managed Underground Storage Facility (USF) permits and Groundwater Savings Facility (GSF) permits; (2) Water Storage (WS) permits; and (3) Recovery Well (RW) permits. For a detailed description of each of these permits, please see the *Water Demand and Supply Assessment 1985-2025, Pinal Active Management Area* (Assessment) on ADWR's website:
http://www.azwater.gov/AzDWR/WaterManagement/Assessments/documents/PinalAssessmentFinal5-23-2011.pdf.

8.3 PHYSICAL ASSESSMENT OF THE PINAL AMA

Achieving the PAMA goal of preserving the agricultural economy for as long as feasible while preserving future water supplies for non-irrigation uses will not eliminate potential water supply challenges facing PAMA water users such as high water tables in recharge areas, and land subsidence and earth fissuring in areas of groundwater level decline. There is a need to develop additional aquifer management strategies during the fourth management period to address the impacts of these varied local groundwater declines and physical availability challenges. Because of possible CAP water shortages projected by the US Bureau of Reclamation, continued drought contingency planning is important as well. Historically, significantly more water storage than recovery has occurred in the PAMA. Further data analysis is needed to quantify how much water may be recovered within the area of impact of storage in the future.

8.3.1 Groundwater Overdraft

Total 2015 water demand in the PAMA was 1,300,126 ac-ft. About 40 percent of this demand, 520,926 ac-ft, was met by groundwater. During most of the years in the historical period (1985 – 2015), the PAMA experienced overdraft. Surplus conditions occurred in the mid 1990's, most notably in 1993 due to extensive flooding that occurred in that year. The most recent surplus conditions occurred in 2005 and 2006, but overdraft conditions remained from 2007 through 2015. Agricultural incidental recharge does not immediately reach the aquifer but takes approximately 20 years after application to crops to make its way to the water table in many locations. Agricultural incidental recharge and stream channel recharge are the major components in the PAMA that help offset overdraft. In addition, the cut to the aquifer for CAP water and managed reclaimed water storage helps to offset overdraft. More than 11,000,000 ac-ft of agricultural incidental recharge and about 1,900,000 ac-ft of stream channel recharge are estimated to have occurred in the PAMA during the historical period from 1985 through 2015.

Groundwater demand in the PAMA decreased until 1993, after which groundwater demand increased to volumes similar to those observed from the late 1980s and early 1990s. Since then, groundwater demand has fluctuated but remained near the same level since 1996. The sum of groundwater plus in-lieu groundwater in recent years is comparable to total groundwater demand in the mid 1980s, which was prior to in-lieu water becoming available. Groundwater is likely to continue to serve as the primary water supply source in the PAMA into the future.

8.3.2 Consequences of Groundwater Overdraft

Although the use of in-lieu and direct CAP water by agricultural users in the PAMA have resulted in groundwater pumping stabilizing and not increasing in the PAMA, remaining groundwater pumping in the PAMA could still negatively impact the AMA's aquifers, particularly at the local level for areas with greater hydrologic sensitivity. Lower groundwater levels could reduce well productivity and increase pumping costs. Lower groundwater levels may increase land subsidence, reducing the aquifer's ability to store water introduced either naturally or artificially through recharge. As shown in Chapter 2 of this plan, land subsidence has already occurred in the PAMA due to groundwater overdraft. Continued lowering of water levels could potentially result in additional land subsidence. Because there is potential for damage due to land subsidence in the PAMA, reduction of groundwater overdraft in subsidence-prone areas could benefit the PAMA. The depletion of the groundwater supplies in local areas within the PAMA may also reduce the groundwater supply physically available for demonstration of an Assured Water Supply (AWS).

As described in Chapter 2 of this plan, groundwater overdraft results in groundwater level declines. During the period 1940 to 2013, maximum water level declines of about 500 feet were observed in the PAMA. Figure 2-8 in Chapter 2 of this plan shows historical water level changes between 2003 and 2013. Some water level stabilization started to occur as early as the 1970s and 1980s in some areas, primarily due to overall decreases in agricultural pumping compared to other peak withdrawal years in the 1950s and 1960s. However, many wells in the PAMA showed significant recovery after the mid 1990s when widespread use of direct and in-lieu CAP water was initiated. Water levels recovered in many wells by as much as 103 feet from 2003 to the year 2013. Table 8-1 summarizes the water storage and recovery through the year 2015 at the AMA level and for the basins in which storage occurred in the PAMA. Approximately 85 percent of the total recovered water was recovered by Central Arizona Water Conservation District (CAWCD) pursuant to the Intentionally Created Unused Apportionment (ICUA) agreement between the AWBA and CAWCD (See section 8.6.1.2 of this chapter for more details.)

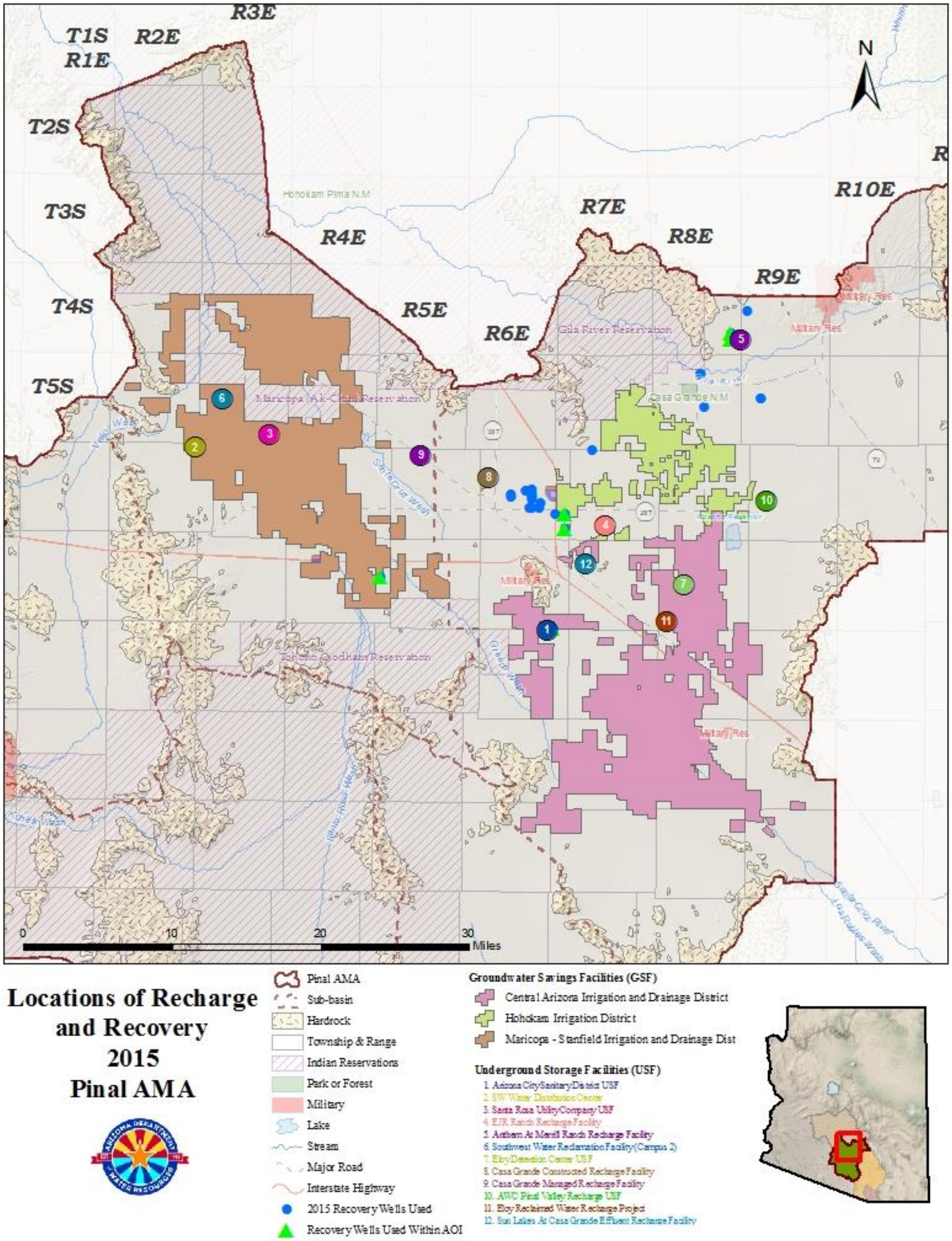
TABLE 8-1
PINAL AMA WATER STORAGE & RECOVERY SUMMARY, 1986 – 2015 (ac-ft)

	Subbasin	Eloy	Maricopa - Stanfield	Multiple Subbasins	AMA TOTAL
Delivered to be Stored through 2015	USF CAP	1,775	-	-	1,775
	USF Reclaimed	16,882	-	-	16,882
	USF TOTAL	18,657	-	-	18,657
	GSF (CAP) TOTAL	1,684,675	1,191,517	17,976	2,894,168
	TOTAL DELIVERED TO BE STORED	**1,703,332**	**1,191,517**	**17,976**	**2,912,825**
Recovered through 2015	CAP	51,013	37,566	-	88,579
	Reclaimed	3,010	-	-	3,010
	TOTAL RECOVERED	54,023	37,566	-	91,589
Recovered Water in 2015	CAP	2,454	2,787	-	5,241
	Reclaimed	611	-	-	611
	Total	3,065	2,787	-	5,852
	Within 1 mile of any storage location	**1,008**	**344**		**1,352**
Recovered Water in 2005	CAP	-	-	-	-
	Reclaimed	299	-	-	299
	Total	299	-	-	299
	Within 1 mile of any storage location	**299**			**299**

8.3.2.1 Eloy Sub-basin

GSF water stored in the Eloy Sub-basin has been stored in the Central Arizona Irrigation and Drainage District (CAIDD) and in the Hohokam Irrigation and Drainage District (HIDD). About 53 percent of the GSF water stored in this sub-basin was stored in the HIDD; the remainder was stored in the CAIDD. USF storage of CAP water in the Eloy Sub-basin was stored at the Hohokam USF and the Gila River Indian Community Olberg Dam pilot facility. Reclaimed water was stored at six different facilities, with the majority of the reclaimed water being stored by Eloy at their USF for reclaimed water.

FIGURE 8-1
PINAL AMA RECHARGE SITES & RECOVERY LOCATIONS



About 58 percent of recovered annual and long-term storage credits have been recovered in the Eloy Sub-basin to date, mostly by CAWCD. Most of the recovered water has been CAP water. Reclaimed water was recovered by the City of Eloy and the Town of Florence.

8.3.2.2 Maricopa-Stanfield Sub-basin
Inside the Maricopa-Stanfield Sub-basin, approximately 1.2 million ac-ft was delivered to be stored at the Maricopa-Stanfield Irrigation and Drainage District (MSIDD) GSF.

More than 41 percent of the recovered annual and long-term storage credits were recovered in the Maricopa-Stanfield Sub-basin, all by CAWCD and all CAP water.

8.3.2.3 Multiple Sub-basins
The AWBA has stored water at a facility located within the Gila River Indian Drainage District (GRIDD). This facility straddles the Phoenix Active Management Area (PHXAMA) and the PAMA. Nearly 18,000 ac-ft of CAP water has been sent to be stored in the PAMA portion of the GRIDD GSF. To date the AWBA has not recovered this water.

8.4 ALTERNATIVE WATER SUPPLIES ASSESSMENT

Renewable water supplies in the PAMA consist of CAP water, Colorado River water, stream flow from the Gila and Santa Cruz Rivers, Salt River Project water, and reclaimed water. CAP water is the primary renewable supply used in the PAMA. Recycling reclaimed water stretches the water supply and has other benefits related to water quality. Surface water resources in the PAMA are variable depending on water that flows during storm events. The following section describes the major water supplies and how they are currently used in the PAMA. For a broader discussion of renewable supplies in the PAMA, see Chapter 2, section 2.9.

8.4.1 Colorado River Water and the Central Arizona Project
The CAP canal delivers Colorado River water to Maricopa, Pinal, and Pima Counties. Figure 8-1 shows the location of the CAP canal and GSF and USF facilities in the PAMA. The following sections describe the PAMA's CAP water supply, current use by water use sectors, and supply reliability challenges related to allocation priorities. Additional discussion of CAP water use challenges may be found in Chapters 2, 5, and 6 and in Appendix 8.

8.4.1.1 Central Arizona Project Water Supply
The CAP is the largest source of renewable water supply available in the PAMA. Annual CAP water allocations for the PAMA include more than 15,000 ac-ft of municipal and industrial subcontracts. The Gila River Indian Community (GRIC) is partially within the PAMA and partially within the Phoenix AMA (PHXAMA). The GRIC CAP contract is more than 300,000 ac-ft per year. The Ak-Chin Indian Community is located entirely within the PAMA and holds a contract for 75,000 ac-ft per year. Additional CAP water may be allocated as a result of the Southern Arizona Water Rights Settlement Act and Non-Indian Agriculture (NIA) Priority CAP water reallocations.

A list of existing CAP water allocations/contracts for the PAMA is presented in Table 8-2. In the PAMA, CAP water use by agriculture began in 1987. In-lieu CAP use has supplemented direct CAP use in this sector. Tribal use of CAP water also began in the year 1987. It is unclear how the PAMA agricultural sector will respond to reductions in CAP agricultural pool water in the future; however, it is likely that some additional groundwater pumping in the agricultural sector will occur as a result of the pool reduction. The extent to which groundwater will replace water demand that is currently met with CAP water will depend on multiple factors, including but not limited to crop prices and the costs associated with drilling new or rehabilitating existing, but unused wells.

TABLE 8-2
PINAL AMA MUNICIPAL & INDUSTRIAL CAP SUBCONTRACTS

Entity	Allocation (Ac-Ft)
MUNICIPAL AND INDUSTRIAL SUBCONTRACTS	
Arizona Water Company	10,884
Eloy	2,171
Florence	2,048
TRIBAL SUBCONTRACTS	
Ak-Chin Indian Community	75,000
Gila River Indian Community	311,800
Tohono O'Odham Nation	24,000
Chui Chu	*8,000*
Schuk Toak	*16,000*
TOTAL	**425,903**

[1] This is the combined allocation for the former Casa Grande and Coolidge systems. In 2010 Arizona Water Company merged the Casa Grande and Coolidge systems into one system, now called the Pinal Valley system.
[2] The Gila River Indian Community has land in both the PHXAMA and the PAMA. The allocation shown is the entire allocation for the GRIC. No attempt has been made in the chart above to divide the allocation between the two AMAs.
[3] There are many districts within the Tohono O'Odham Nation. CAP subcontracts are specified for Chui Chu for irrigation and for the San Xavier and the Schuk Toak districts (Tribal Homeland). Chui Chu is a Census Designated Place that is located within the Sif Oidak district which is completely within the PAMA. In addition, much of the Schuk Toak and Gu Achi districts are within the PAMA. A small portion of the Schuk Toak district is within the TAMA. The volume shown is the entire subcontract amounts for Chui Chu and the Schuk Toak district. No attempt has been made in the chart above to divide the Schuk Toak allocation between the two AMAs.

Excess CAP water from unused entitlements and surplus Colorado River supplies have historically provided an opportunity to bring additional CAP water supplies into the PAMA beyond existing allocations. The volume of excess CAP fluctuates depending on the use of CAP subcontracts and allocations and the availability of the overall CAP supply. Based on projections by the US Bureau of Reclamation, there is a probability that Colorado River water shortages may occur in the future. Lower than average precipitation on the Colorado River watershed may increase the likelihood of these shortages occurring. Because CAP delivers mostly lower priority Colorado River water, Colorado River supplies for the CAP (and certain on-river/mainstem users) have a junior priority compared with other on-river/mainstem users, Colorado River supplies for the CAP will be reduced in times of a declared shortage in the Lower Colorado River Basin. As insurance against the impacts of future shortages, unused CAP supplies have been recharged by individual entities within the PAMA holding water storage permits.

In addition to long-term storage and recovery, CAP water is also stored and recovered annually. This mechanism, although it involves recharge, is analogous to direct use because no long-term storage credits are generated.

Central Arizona Project Water Supply Reliability
The reliability of CAP water supplies and delivery scheduling has implications for the use of CAP water by entities within the PAMA. Arizona's CAP water holds a junior priority water entitlement to the Colorado

River among the Lower Colorado River Basin States. It, and other junior priority uses in Arizona and Nevada, may be subject to reductions during times of shortage. Although projected shortages are not expected to impact CAP's high priority Municipal and Industrial (M&I) subcontractors, it is unclear how the agricultural community in the PAMA would react to a shortage. Irrigation districts have additional well capacity and could do additional groundwater pumping during times of shortage, but it is unlikely that the additional pumping would equal the volume of CAP that would otherwise had been delivered if there were no shortage of CAP.

Municipal Use of Central Arizona Project Water

Arizona Water Company, the City of Eloy and the Town of Florence all have subcontracts with CAWCD for allocations of municipal CAP water. For the most part, the municipal providers have continued to rely on groundwater to supply their service areas. CAP water must be treated to meet drinking water standards, and the providers do not have the facilities to treat it. The City of Eloy, however, has directly used several hundred ac-ft annually of its CAP allocation since 1992 for watering the city's municipal golf course and, beginning in 1996, the community cemetery as well. In addition, Arizona Water Company began using a small portion of its allocation in 1994 for its Casa Grande system to supply water to a new, private golf course.

Given the high costs associated with constructing treatment facilities, the most realistic way that the municipal providers in the PAMA have for increasing their use of CAP water is to recharge it. Table 8-3 shows the volume of water stored by entity since 1989. Not all water stored is recoverable. As discussed in section 8.2.2 of this chapter, water stored by the CAGRD is to offset groundwater pumping associated with post-1995 subdivisions that are enrolled as member lands in the CAGRD and for municipal water providers who are member service areas in the CAGRD.

TABLE 8-3
PINAL AMA WATER STORED BY ENTITY (ac-ft)

Entity	Stored (1989-2015)
Arizona Water Banking Authority	1,506,075
Gila River Indian Community	723,567
CAWCD	494,745
Pinal Co. Water Augmentation Authority	67,810
Resolution Copper Mining	60,390
SRP Ag Impr .& Power District	28,074
City of Eloy	8,527
Coolidge Power Corporation	6,000
Arizona Water Company - Pinal Valley	5,000
Johnson Utilities, LLC	3,619
Town of Florence	2,043
Corrections Corporation of America	3,704
CAGRD Conservation District Account	2,057
Arizona City Sanitary District	839
Santa Cruz Water Company	230
Picacho Sewer	145
CAGRD Replenishment Reserve Sub-acct	0
CAWCD (CAGRD Sub-account)	0
TOTAL	**2,912,825**

See Chapters 2, 3 and 5 of the plan for additional information on CAP water use by municipal providers. See Chapter 7 for additional information on water quality challenges.

Figure 8-1 shows the locations of recharge sites. Table 8-4 lists the facilities, permitted storage volumes, and volume stored as of 2015. A total of 2,894,168 ac-ft were delivered to be stored at GSF's in the PAMA between inception of the program and the end of 2015.

TABLE 8-4
PINAL AMA WATER STORAGE FACILITIES

Name	Permit Volume (ac-ft/year)	Source Water	Water Delivered to be Stored (ac-ft)
Anthem at Merrill Ranch Recharge Facility	3,360	Reclaimed	3,619
Arizona Sanitary District USF	2,240	Reclaimed	839
Central Arizona Irrigation & Drainage District	110,000	CAP	785,636
EJR Ranch USF	2,092	Reclaimed	
Eloy Detention Center USF	2,726	Reclaimed	3,704
Eloy Reclaimed Water Recharge Project	2,240	Reclaimed	6,532
Global Water - Palo Verde Utilities Company	2,240	Reclaimed	
GRIDD	18,480	CAP	17,976
GRIC Olberg Pilot USF	7,500	CAP	452
Hohokam Irrigation & Drainage District GSF	55,000	CAP	899,039
Hohokam Recharge Facility #1	850	CAP	1,323
Maricopa-Stanfield Irrigation & Drainage District GSF	120,000	CAP	1,191,517
Santa Rosa Utility Company USF	2,577	Reclaimed	
Southwest Water Reclamation Facility (Campus 2)	2,240	Reclaimed	
Sun Lakes at Casa Grande Effluent Recharge Facility	340	Reclaimed	145
Town of Florence USF	135	Reclaimed	2,043
TOTAL	**332,020**		**2,912,825**

NOTE: Total may not match due to rounding.

Agricultural Use of Central Arizona Project Water

Central Arizona Irrigation and Drainage District (CAIDD), Hohokam Irrigation and Drainage District (HIDD), and Maricopa-Stanfield Irrigation and Drainage District (MSIDD) entered into non-Indian CAP agricultural subcontracts with the Central Arizona Water Conservation District (CAWCD) between 1983 and 1984. CAIDD relinquished its subcontract entitlement in accordance with the Arizona Water Settlement Agreement (AWSA). MSIDD also agreed to relinquish its CAP subcontract entitlement, but designated 9,026 ac-ft for the benefit of the Arizona State Land Department (ASLD) in accordance with the AWSA; however ASLD's subcontract was terminated September 1, 2009 and the 9,026 ac-ft of Non-Indian Agricultural (NIA) priority water was added back to the pool of un-contracted NIA priority water. The cities of Chandler, Mesa, Phoenix, and Scottsdale acquired the HIDD subcontract entitlement in 1992 as a replacement for the water supply that would have been developed by Cliff Dam, which was not built. San Carlos Irrigation and Drainage District (SCIDD), which was established in 1928 to deliver Gila River water and groundwater to the non-Indian part of the San Carlos Irrigation Project, did not sign a subcontract.

Agricultural use of in-lieu CAP water in the PAMA peaked in the year 1993 at 232,854 ac-ft. Since then, the volume has fluctuated. In the year 2015, in-lieu CAP was 80,627 ac-ft. See Chapter 4 for further discussion of agricultural CAP water use and section 8.7.3 for current program incentives to encourage CAP water use.

Direct use of CAP water increased rapidly after its inception in 1986, reaching a peak in 2003 of 332,470 ac-ft. When the price for CAP water rose in 1991, CAP usage dropped significantly in the districts, reaching a record low of 28,296 ac-ft in 1993. In 1993, CAWCD established an incentive pricing program for non-Indian agricultural CAP water, beginning in 1994 and ending in 2003, to encourage greater direct use of these supplies. This restructuring program was established primarily to address the inability of the irrigation districts in the PAMA and PHXAMA to meet their obligations to CAWCD under their CAP subcontracts. In exchange for waiving their entitlements to CAP water under their subcontracts, the irrigation districts would receive excess CAP water. The program, called "target pricing," created three pools of agricultural supplies.

After 2003 CAP adopted special pricing for agricultural water by creating categories of excess CAP. This pricing created the 400,000 acre-foot CAP agricultural pool, which reduces to zero in the year 2031 and has steps down to 300,000 ac-ft in 2017 and 225,000 ac-ft in 2024.

Calendar year 2017 pricing is $77 per acre-foot for Agricultural Settlement Pool water, which is equivalent to the pumping energy rate.

Tribal Use of Central Arizona Project Water

The three Indian communities in the PAMA all have allocations of CAP water. The three communities are: (1) the Ak-Chin Indian Community, (2) the Gila River Indian Community, and (3) the Tohono O'odham Nation. In 2015, the Ak-Chin used 77,235 ac-ft of CAP water, the Tohono are estimated to have used 13,000 ac-ft of groundwater for farming in the Chuichu and Vaiva areas, and the GRIC are estimated to have used 11,606 ac-ft of surface water, 49,092 ac-ft of groundwater and 5,464 ac-ft of CAP water on the PAMA portion of their land.

<u>Ak-Chin Indian Community</u>

The Ak-Chin Community was awarded, by Congressional action in 1978 and 1984, an annual entitlement of 75,000 ac-ft of CAP and other Colorado River water. In wet years, the amount awarded may increase to 85,000 ac-ft. Congress amended this 1984 Act in 1992 to authorize the Community to lease any unused CAP water to off-reservation users within the Tucson, Pinal and Phoenix AMAs (ADWR, 2010).

<u>Gila River Indian Community</u>

In December 2004, the President signed into law the Arizona Water Settlements Act. Title II of the Act provided approval of the Gila River Indian Water Settlement Agreement. The settlement awarded the GRIC an annual entitlement to 653,500 AF of water from various sources including CAP allocations, reclaimed (through CAP exchange), groundwater, and surface water from the Gila, Verde and Salt rivers. It also established a funding mechanism for on-reservation development of this Community's farming operations and gave leasing authority to the GRIC for its CAP water as long as the water is leased within Arizona (ADWR, 2010).

<u>Tohono O'odham Nation</u>

Congress enacted the Southern Arizona Water Rights Settlement Act (SAWRSA) in 1982 to address the water rights claims of the San Xavier and Schuk Toak Districts of the Tohono O'odham Nation. This Act awarded to the two districts an annual entitlement of 37,800 acre feet of CAP water and 28,200 acre feet of settlement water to be delivered by the Secretary of the Interior. The district may also pump up to 13,200 acre feet of groundwater annually from non-exempt wells. An amendment to the Act signed into law by the President in 2004 identified the source of the settlement water as CAP Non-Indian Agricultural priority water, which the Nation is permitted to lease within the CAP service area. This Nation's water right claims are not completely satisfied, however, as the claims of the Sif Oidak District in Pinal County have not yet been addressed. This District has a contract for 8,000 ac-ft of CAP annually but has stated the need for nearly 100,000 ac-ft. As such, the Nation has requested that a federal negotiation team be established to begin negotiations (ADWR, 2010).

Industrial Use of Central Arizona Project Water

Most industrial users in the PAMA have chosen not to pursue CAP water supplies. CAP was first used in the industrial sector in the PAMA in 2001. Currently CAP water is not being used at any industrial facilities in the PAMA. However untreated CAP is currently being used by turf-related facilities served by municipal water providers at Performance Institute Park, Coolidge Central & High School, Coolidge West Elementary School, Francisco Grande Golf Club and the San Miguel Golf Course. These facilities used a total of about 1,563 ac-ft in 2015. Because this water was municipally served it is included under the municipal sector rather than in the industrial demand sector.

8.4.2 Surface Water

Streamflow from the Gila River is the only other major source of renewable water supply for the PAMA. As previously mentioned, SCIDD has delivered water diverted from the river to irrigate farmland within its boundaries since 1928. The amount of water diverted by the irrigation district varies greatly from year to year, depending largely on availability of supplies and much less so on level of demand. Between 1985 and 2015, the agricultural sector in the PAMA used an average of about 107,200 ac-ft per year. In addition to agricultural irrigation water, the district also delivers water to several schools, parks, and subdivisions in Casa Grande and Coolidge for non-potable uses, principally turf and lawn watering. These uses averaged about 460 ac-ft per year between 1985 and 2015.

Gila River water is also diverted by the San Carlos Irrigation Project for delivery to project farmland within the Gila River Indian Reservation. While most of this farmland is located in the PHXAMA, an estimated average of about 16,400 ac-ft of these supplies are used annually to irrigate the farmland that is located in the PAMA.

8.4.3 Reclaimed Water

Reclaimed water has been recharged in the PAMA since 1989. There are currently 10 active storage facilities where reclaimed water can be stored with a combined maximum annual storage capacity of 20,190 ac-ft per year. To date, a cumulative total of 16,882 ac-ft of reclaimed water has been sent to be stored at reclaimed water storage facilities in the PAMA.

Since 1985, direct use of reclaimed water in the PAMA has increased from less than 1,850 ac-ft to approximately 5,000 ac-ft in 2015. Direct use of reclaimed water has fluctuated over the years, from a high of 5,843 ac-ft in 1987 to a low of 1,356 ac-ft in 1998. The principal user of reclaimed water in the PAMA is one farm who receives reclaimed water from the Town of Florence.

8.5 PAMA 4MP AUGMENTATION & RECHARGE PROGRAM GOALS AND OBJECTIVES

This Recharge Program chapter has thus far highlighted the physical groundwater supply conditions in various locations throughout the PAMA, the availability of renewable water supplies, the successes and shortcomings of the Recharge Program during the third management period in the PAMA, and the water management challenges facing the PAMA during the fourth management period. ADWR has developed the goals and objectives of the Recharge Program for the fourth management period based upon these PAMA considerations. The Recharge Program for the fourth management period is intended to assist the PAMA in achieving its water management goals and to begin to address sensitive areas by emphasizing the following objectives:

- Encourage the maximum direct use of CAP water by irrigation districts within the PAMA.
- Retain and fully utilize all of the municipal CAP allocations within the PAMA.
- Utilize the CAP delivery system to the maximum extent possible to store unused Colorado River water within the AMA.
- Maximize the recharge of renewable water supplies, including reclaimed water that cannot be used directly.

During the fourth management period ADWR will consider efforts such as:

- Developing groundwater monitoring programs to facilitate effective development of a regional recharge plan and achievement of water management objectives.
- Developing and implementing a regional recharge plan to coordinate storage and recovery of renewable water supplies to enhance local aquifer management.
- Integrating AWS, water banking, groundwater replenishment, and related activities to facilitate achievement of water management objectives.

The possibilities and need for augmentation during the fourth management period differ substantially among the five AMAs. ADWR will continue to assist water users in developing additional water supplies and maximizing the use of existing alternative water supplies in meeting the PAMA water management goal. To accomplish this, ADWR will first seek to identify all potential measures available to the PAMA. Proposed measures will be evaluated based on their cost and physical practicality in implementation. The amount of information available for water management has already increased through the development of groundwater and surface water monitoring programs by ADWR to facilitate effective implementation of water augmentation and recharge plans.

8.6 THE PAMA 4MP RECHARGE PROGRAM

ADWR is required to include in the 4MP "if feasible, a program for additional augmentation of the water supply of the active management area, including incentives for artificial groundwater recharge" (A.R.S. § 45-567(A)(5)). Pursuant to A.R.S. § 45-561(2), "Augmentation means to supplement the water supply of an active management area and may include the importation of water into the active management area, storage of water or storage of water pursuant to chapter 3.1 of this title." The Recharge Program must be consistent with this statute, but, as described in the introduction, for purposes of this chapter *augmentation* means increasing the availability and use of renewable supplies such as reclaimed water in lieu of groundwater and *recharge* means storage of water pursuant to Title 45, Chapter 3.1, the Underground Water Storage, Savings and Replenishment Act. The Recharge Program, therefore, includes provisions for maximizing the use of renewable supplies and for storage of renewable water.

The principal responsibility for developing water supplies and for storing that water for future uses lies with the PAMA's water users. ADWR's responsibility under A.R.S. § 45-567(A)(5) is to design a program that encourages and facilitates the efforts of those water users. The program should particularly encourage augmentation and storage of water where groundwater supplies are limited. The Recharge Program also strives to avoid aggravating existing local water supply problems.

The Recharge Program for the 4MP includes the statutory requirements for storing and recovering water within an AMA. The key statutory provisions for storage facilities relate to hydrologic feasibility (A.R.S. § 45-811.01(C)(2)); protection of land and other water users from unreasonable harm (A.R.S. § 45-811.01(C)(3)); and avoidance of water quality impacts (A.R.S. § 45-811.01(C)(5)). The Underground Water Storage, Savings and Replenishment Act requires certain types of storage and recovery to be found consistent with the management plan and management goal for the AMA. The provision that governs non-recoverable storage includes a requirement that non-recoverable water storage must be consistent with the AMA's Recharge Program (A.R.S. § 45-833.01(A)). Provisions governing recovery allow stored water to be recovered outside the area of impact of the stored water only if certain conditions are met (A.R.S. § 45-834.01). One of the conditions is that the Director must determine that recovery at the proposed location is consistent with the management plan and management goal of the AMA (A.R.S. § 45-834.01(A)(2)(b)(ii)).

ADWR has developed the Recharge Program for the 4MP to address the goals and objectives identified in the previous section. The program components are discussed in the following sections.

8.6.1 Arizona Water Banking Authority

The AWBA was established in 1996 to store Arizona's unused allocation of Colorado River water for use in the future to meet the following objectives: 1) protect municipal and industrial (M&I) users of CAP water from shortages or disruptions to the CAP system, 2) assist in meeting the management objectives of the state's Groundwater Code (Code), 3) assist in the settlement of Indian water rights claims, 4) exchange water to assist Arizona's Colorado River communities and 5) explore opportunities for interstate water banking with Nevada and California. To this end, the AWBA has recharged more than 4.2 million ac-ft (MAF) of excess CAP water within the Central Arizona Water Conservation District's (CAWCD) service area through 2015. Long-term storage credits (credits) accrued from this storage total 4.03 MAF and include 3.43 MAF for Arizona uses and 0.6 MAF for interstate storage, specifically, the Southern Nevada Water Authority (SNWA).

As shown in Table 8-5 the AWBA has accrued 1,443,040 ac-ft of credits in the PAMA, of which 440,241 ac-ft are for SNWA. The highest percentage of credits accrued have been at the MSIDD GSF (44 percent), followed by the HIDD GSF (32 percent), and then CAIDD GSF (24 percent). The remaining water was stored at the GRIDD.

The AWBA is authorized to use four main revenue sources to accomplish its objectives:

- General Fund appropriations received at the discretion of the Legislature;
- Groundwater Withdrawal Fees of $2.50 per ac-ft collected in the Tucson, Phoenix, and Pinal AMAs collected by ADWR;
- An *ad valorem* property tax (4¢ tax) levied and collected by CAWCD in its three-county CAP service area; and
- Monies received for interstate banking

While the AWBA is authorized to use these funding sources, the revenues available from each source vary both on an annual basis and by the amounts collected within each AMA or County. There are also limitations on how each fund may be utilized by the AWBA to achieve its various goals.[4] The availability and use of funds for any given year are described in the AWBA's Annual Plan of Operation.

In addition to its primary funding sources, the AWBA also received funds pursuant to the Arizona-Nevada Shortage-Sharing Agreement executed on February 9, 2007. Under this agreement, SNWA agreed to provide $8 million to the AWBA to assist Arizona in offsetting impacts from any shortages during the "Interim Period".[5] These "Shortage Reparation" funds have been used by the AWBA to accrue credits in

[4] A.R.S. § 45-2425 describes how revenues are made available to the Arizona Water Banking Fund and A.R.S. § 45-2457 describes how these revenues may be used.

[5] The Interim Period is the period beginning on the date the US Secretary of the Interior issued the Colorado River Interim Guidelines for the Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead, December 13, 2007, and ending on December 31, 2025 (through preparation of the 2026 Annual Operating Plan).

each of the three AMAs. Any credits not utilized during the Interim Period will continue to be available to the AWBA for future firming purposes.

TABLE 8-5
PINAL AMA AWBA CREDITS ACCRUED & LOCATION THROUGH 2015

	Storage Facility	AWBA Long-term Storage Credits (ac-ft)		
		Intrastate	**Interstate**	**Total**
GSF	GRIDD	17,077	-	17,077
	Maricopa-Stanfield Irrigation & Drainage District	376,101	251,300	627,401
	Central Arizona Irrigation & Drainage District	225,519	117,514	343,033
	Hohokam Irrigation & Drainage District	384,102	71,427	455,529
	Total	**1,002,799**	**440,241**	**1,443,040**

NOTE: Totals may not add due to rounding.

Table 8-6 below identifies the volume of credits the AWBA has accrued in the PAMA for each funding source. The majority of the credits accrued (31 percent) are for Interstate Banking on behalf of Nevada.

TABLE 8-6
PINAL AMA AWBA CREDITS ACCRUED
PER FUNDING SOURCE THROUGH 2015*

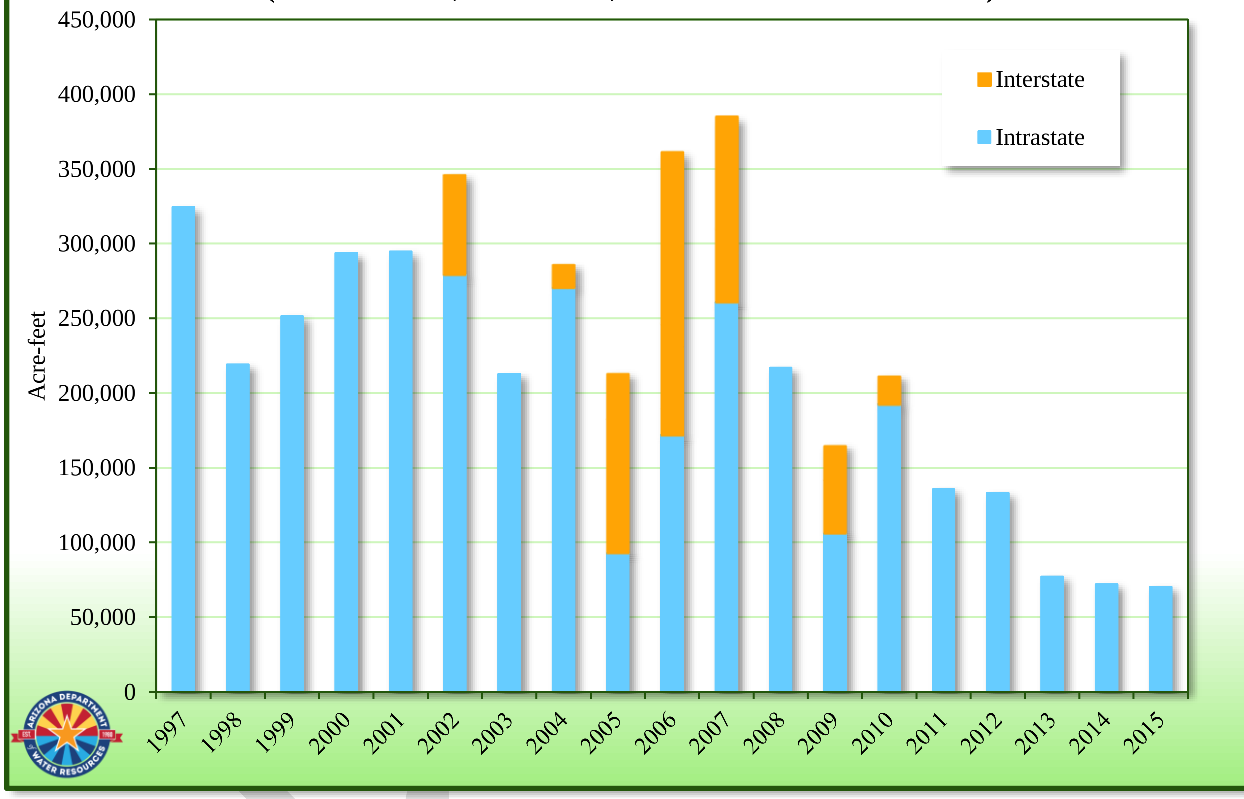
Funding Source	Long-term Storage Credits (ac-ft)
Groundwater Withdrawal Fees	413,518
Four-cent *Ad Valorem* Tax	207,681
General Fund	306,968
Appropriation for Indian Firming	-
Shortage Reparation	60,507
Other[1]	14,125
Interstate Banking - Nevada	440,241
Total	**1,443,040**

*Credits accrued from AWBA water provided to Pinal AMA GSFs at full cost to the GSF operator

As illustrated in Figure 8-2, the volume of excess CAP water available to the AWBA has historically been over 200,000 ac-ft per year with volumes peaking in 2006 and 2007 at 361,220 ac-ft and 384,890 ac-ft, respectively. This trend began to shift in 2008 due to an increase in use by higher priority CAP water users, which decreased the amount of water available to the excess pool. The volumes available to the AWBA within the excess pool also decreased, fueled primarily by a decrease in the rate for incentive-priced recharge water. While it has always been anticipated that the amount of excess CAP water available to the AWBA would decrease over time, these decreases occurred earlier than expected.

In June of 2009, recognizing that demand for excess CAP water was exceeding supplies and the beneficial value of the AWBA to both CAWCD and the AMAs for meeting water management objectives, the CAWCD Board of Directors (Board) created an excess pool of up to 175,000 ac-ft that would be available to the AWBA from 2010 through 2014[6]. The AWBA shares this pool with the CAGRD for replenishment reserve purposes and the federal government for meeting its Indian firming responsibilities. The AWBA's statutes were also amended in 2010, affirming the AWBA's ability to store or replenish excess CAP water made available by CAWCD exclusively for the AWBA. The CAWCD Board subsequently also discontinued its incentive-priced recharge pool since incentives for recharge were no longer needed. Even so, the amount of excess CAP water available to the shared pool also decreased. These changes in water availability could limit the AWBA's progress toward meeting its goals and obligations in the future. As a potential solution, the AWBA could seek other sources of renewable water supplies, including the purchase of existing credits[7], to achieve its objectives.

FIGURE 8-2
ANNUAL AWBA DELIVERIES FOR WATER STORAGE
(Phoenix AMA, Pinal AMA, and Tucson AMA Combined)



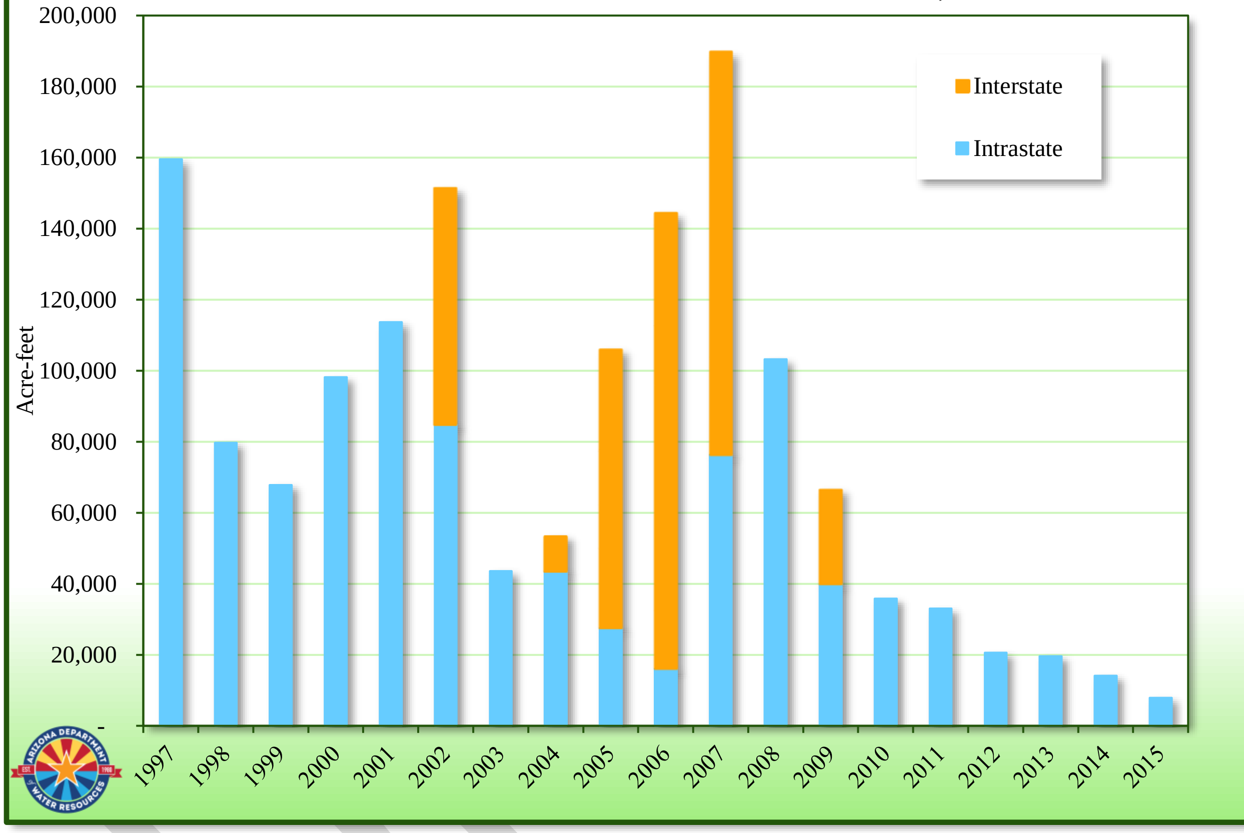
NOTE: Storage in 2004 and 2009 included 10,000 ac-ft and 51,387 ac-ft, respectively, of Nevada's unused Colorado River apportionment stored on behalf of SNWA.

Annual AWBA water storage in the PAMA are quantified in Figure 8-3 below. While the GSFs in the PAMA have a substantial amount of storage capacity, the AWBA's use of that capacity has often been limited because of the amount of revenues collected annually in the AMA. The fluctuation in AWBA storage over the years can be attributed directly to times when the AWBA has had other sources of funds available to store water, including annual general fund appropriations through 2001, funds for interstate storage between 2002 and 2009, and shortage reparation funds in 2008 and 2010. The recent rise in excess

[6] The CAWCD Board adopted a policy on March 6, 2014, creating a similar pool known as the "Statutory Firming Pool" that will be available to the AWBA, CAGRD, and the Bureau of Reclamation from 2015 through 2019.
[7] The AWBA's governing statutes were amended in 2014 to allow the AWBA to purchase long-term storage credits after all available Excess CAP water supplies have been scheduled for storage.

CAP water delivery costs has also played a role in the amount of water the AWBA has been able to store. Even so, through 2015, nearly 1.5 million ac-ft of water has been delivered for AWBA storage in the PAMA. By bringing additional CAP water into the AMA, the AWBA has played an important water management role, effectively reducing the amount of groundwater pumped by agricultural interests. AWBA storage accounts for approximately 73,000 ac-ft of water provided as a benefit to the aquifer (5 percent cut).

FIGURE 8-3
PINAL AMA AWBA DELIVERIES TO WATER STORAGE, 1997 - 2015



As illustrated in Figure 8-3, the AWBA began storing water pursuant to its interstate water banking program in 2002. In that first year, the PAMA was the recipient of the full 66,595 ac-ft of water delivered for interstate storage. The AWBA has since accrued over 440,000 ac-ft of storage credits in the PAMA on behalf of SNWA. Absent interstate storage, this volume represents groundwater that could have been withdrawn from within the irrigation districts. While short-term, the PAMA has benefitted from the importation of the additional water supplies into the AMA in advance of when those supplies will be needed for interstate use.

8.6.1.1 Assistance in Settlement of Indian Water Rights Claims

The Arizona Water Settlements Act (AWSA) P.L. 108-451, which settles longtime claims to water by the Gila River Indian Community (Community) and the Tohono O'odham Nation (Nation), was enacted in December of 2004. The State, under Section 105(b)(2) of the AWSA, is required to: 1) firm 15,000 ac-ft of non-Indian agricultural (NIA) priority CAP water re-allocated to the Community; 2) firm 8,724 ac-ft of NIA priority CAP water re-allocated in the future to Arizona Tribes; and 3) assist the US Secretary of the Interior (Secretary) in its firming requirement for the Nation by providing $3 million in cash or in-kind goods or services, including water, to the Secretary. For a 100-year period and during times of shortage, the AWSA requires the State to firm delivery of CAP water to certain Arizona Tribes with NIA priority water to the same level of priority the State would likewise firm delivery of CAP water to M&I priority users. The Indian Firming Study Commission (IFSC), created by the Arizona State Legislature (Legislature) to evaluate the potential alternatives for meeting the State's obligations under the AWSA, concluded that the volume of water needed to meet the state's 100-year firming obligation under the AWSA was 550,000 ac-ft: 350,000 ac-ft for the Community and 200,000 ac-ft for future settlements. The IFSC also concluded that the AWBA was the most appropriate entity to fulfill the State's firming obligations. The AWBA was subsequently given this authority pursuant to A.R.S. § 45-2491.

Presently, the AWBA's settlement obligation in the PAMA is limited to firming NIA priority CAP water re-allocated to the Community. This obligation is shared with the PHXAMA since Community lands straddle the boundaries of both AMAs. In 2006, with the intent of getting an early start on fulfilling its obligation to the Community, the AWBA entered into a water storage agreement with the Gila River Indian Irrigation and Drainage District (GRIIDD) for storage at the GRIIDD GSF. The AWBA and the Community had agreed that upon enforceability of the AWSA, credits accrued by the AWBA at the GSF would be dedicated toward meeting future firming obligations to the Community. Specifically, the AWBA agreed to extinguish its credits and the Community agreed to accept the stored water as meeting an equal portion of the state's firming obligation. Storage at the GRIIDD GSF also required the issuance of two separate water storage permits, one for each of the AMAs. The AWBA subsequently accrued 105,390 ac-ft of credits at the GRIIDD GSF: 17,077 ac-ft for the PAMA and 88,313 ac-ft for the PHXAMA. The GSF permit expired when the Community began taking its CAP entitlement in 2010 in accordance with the payment schedule described under the AWSA.

On November 15, 2007, the AWBA and the Secretary entered into an agreement that defines the AWBA's obligation to firm water during times of shortage. The agreement also allows the AWBA to enter into separate agreements with Indian communities to develop firming plans that will be used to meet its obligations. With enforceability of the AWSA in December of 2007, the AWBA has a firming responsibility through 2107. On June 16, 2015, the AWBA and the Community executed an intergovernmental agreement (IGA) that describes the procedures for developing and carrying out a firming plan during shortage years. It also identifies several methods that can be used for this purpose, which includes the use of the credits that were accrued at the GRIIDD GSF.

Replenishment

In addition to meeting the firming requirements of the AWSA, the AWBA is responsible for satisfying replenishment obligations that may be created from off-reservation groundwater pumping in the Southside Protection Zones.[8] By October 1 each year, the Director must notify the AWBA if a replenishment obligation has been incurred and the entity that is responsible for creating the obligation. Upon notification, the AWBA will have three years to satisfy a municipal or industrial obligation and five years to satisfy an agricultural obligation. Obligations may be satisfied in several ways and include delivering water directly to the Community, extinguishing long-term storage credits, or debiting the Southside Replenishment Bank discussed below.[9] There have been no replenishment obligations created through 2015.

The AWSA also required that the AWBA establish a Southside Replenishment Bank (SRB) and to create an account for the Community within the SRB by delivering 15,000 ac-ft of water, a minimum of 1,000 ac-ft per year, directly to the Community. On June 19, 2009, the AWBA and the Community entered into an IGA that describes the annual process for making these deliveries, as well as deliveries that might be needed

[8] The eastern protection zone north, the eastern protection zone south, the western municipal protection zone, the western municipal and industrial protection zone and the central protection zone established under § 45-2602

[9] The extent to which these methods may be used is described under § 45-2623 and § 45-2624.

to satisfy a replenishment obligation. The AWBA satisfied this obligation in 2015. The SRB must be maintained at no less than 5,000 ac-ft once used.

8.6.1.2 Distribution and Recovery of AWBA Long-term Storage Credits in PAMA

Based on current modeling projections, the AWBA does not anticipate the need to firm on-River or CAP M&I priority supplies before 2025.[10] There is a chance, however (< 30 percent), that the AWBA will need to firm NIA priority supplies during this time as required under the AWSA. Within the PAMA, this obligation would currently include the AWBA's firming obligation to the Community. As previously mentioned, the AWBA and the Community have entered into an IGA that identifies several methods that can be used to satisfy a firming obligation. While most of these methods focus on the extinguishment of AWBA credits accrued on or near Community lands, traditional recovery by CAWCD is also an option. However, it would first require an agreement between the AWBA and CAWCD before this option could be used. Recovery for the development of Intentionally Created Unused Apportionment (ICUA) for Nevada is not projected to occur until sometime after 2025.

To prepare for meeting future firming requirements and for the development of ICUA, the AWBA, CAWCD and ADWR, in cooperation with stakeholders, developed a recovery plan that provides a framework for how the AWBA's credits will be recovered in the future.[11] The recovery plan identifies various methods that can be used for recovering AWBA credits such as direct recovery by CAWCD, indirect recovery with third parties, and credit exchanges with recovery partners. The recovery plan also makes recommendations on the opportunities for recovery within each AMA. In the PAMA, these recommendations include to a larger extent, the development of cooperative agreements with agricultural and Tribal CAP water users as third party recovery partners. Further analysis on potential future direct recovery sites is also recommended. While not recovering for the AWBA, CAWCD has already had experience with recovery in the PAMA when it recovered credits accrued in the early 1990s on behalf of the Metropolitan Water District of Southern California (Metropolitan). Through indirect recovery partnerships with MSIDD, CAIDD, and HIDD, CAWCD recovered 74,026 ac-ft of water to make ICUA available for diversion by Metropolitan between 2007 and 2010. The water was recovered from the irrigation districts' wells and used by the districts who had agreed to take a portion of their CAP Agricultural (AG) Pool water as recovered water. CAWCD has maintained these partnerships since 2007 as part of a recovery incentive program. Although a successful method for developing ICUA, this recovery method is limited to years when there are no shortages to the AG Pool. Therefore, CAWCD would need to enter into other partnerships that do not rely on the AG Pool if the indirect recovery method is used during shortages. By defining the location of future recovery sites, the recovery plan will also assist the AWBA in making future storage decisions. At this time, the AWBA's only alternative for storage in the PAMA is at the three GSFs. If there were USFs with storage capacity available to the AWBA in the future, the credit exchange method could also be used as an option for meeting the AWBA's firming obligations.

8.6.1.3 Recommendations to the Arizona Water Banking Authority

One of the stated purposes of the legislation creating the AWBA is to "store water brought into this state through the CAP to fulfill the water management objectives of this state set forth in chapter 2 of this title" (A.R.S. § 45-2401(H)(3)). The AWBA is required to coordinate with the Director of ADWR, who serves as chair of the AWBA Commission, in the "storage of water and distribution and extinguishment of long-term storage credits … in accordance with the water management objectives set forth in chapter 2 of this title [the Code]." A.R.S. § 45-2423(A)(3). To meet these statutory requirements, ADWR must provide specific advice to the AWBA as to how to incorporate such objectives into the AWBA's activities.

[10] Arizona Water Banking Authority 2015 Annual Report.

[11] The Preface to the *Recovery of Water Stored by the Arizona Water Banking Authority – A Joint Plan by AWBA, ADWR and CAP* that acknowledges the plan advances the objectives of the Intergovernmental Agreement among the Parties, was executed on May 6, 2014.

Specifically, the Groundwater Code requires that ADWR include recommendations to the AWBA in the 4MP regarding the following three questions: 1) whether additional water storage in the AMA would help to achieve the management goals of the AMA, 2) where the additional water storage would be most useful in achieving the management goal, and 3) whether the extinguishment of credits would assist in achieving the management goal. ADWR provides the following recommendations to the AWBA for water storage in the AMA.

Advice to the AWBA on Additional Water Storage in the AMA

It is clear that water storage by the AWBA helps to meet the water management objectives of the PAMA. Because the AWBA has not met its M&I or Tribal firming goals in the PAMA, ADWR recommends that the AWBA continue to store water in the PAMA so that further progress can be made on achieving these goals.

Advice to the AWBA on the Location of Water Storage in the PAMA

To better manage local aquifers, ADWR recommends that the AWBA continue to work with CAWCD and PAMA interests to select sites for recharge that are also expected to have future recovery capabilities. ADWR also recommends that the AWBA seek opportunities to store water in the vicinity of M&I subcontractors should USFs become available in these areas in the future.

Advice to the AWBA on Water Storage Credit Extinguishment

While the extinguishment of withdrawal fee credits to provide water management benefits is always desirable, recognizing that the AWBA has an obligation to meet the state's obligations under the AWSA and that the AWBA may use withdrawal fee credits for this purpose, ADWR recommends that the AWBA hold these credits in reserve at this time. Additionally, ADWR recommends that the AWBA be conservative in how it distributes credits during times of shortage and only distribute credits to mitigate shortages for direct use demands, including demands that are met through annual storage and recovery. If withdrawal fee credits were to become available for extinguishment, ADWR recommends that the AWBA develop a program in cooperation with the PAMA water users and interested parties to extinguish storage credits specifically in areas of ongoing overdraft.

8.6.2 Storage and Recovery Siting Criteria

Recharge Program water management benefits are dependent upon the location of storage and recovery. Because recovery outside the area of impact must be consistent with the PAMA's management plan and management goal, the locations of storage and recovery of water are inherently linked. Both must be considered when determining whether the future recovery of stored water meets the requirement for consistency with the management plan and management goal of the PAMA. Therefore, the criteria to determine whether the recovery location is consistent with the management plan and goal for the PAMA must also consider where water was stored.

The locations of storage and recovery are also important factors in addressing local and regional supply problems, particularly in areas experiencing severe water level declines, land subsidence, or other aquifer management issues, and in attempting to balance the PAMA's supplies during the fourth management period. For example, these locations are also crucial because future PAMA water supplies may be diminished if water storage occurs in a remote location with no future demand for the stored water and recovery occurs in an area experiencing water level declines. On the other hand, if storage occurs in an area experiencing high water levels and recovery occurs away from the area of impact, the water storage will contribute to those high water levels. If dewatering is required as a *direct* result of water storage or savings, either the storage facility's operational plan should be adjusted to minimize impacts, which may include strategic recovery locations to mitigate impacts, or the storer may not be issued credits.

Pursuant to A.A.C. R12-15-716(B)(3)(c)(ii), the AWS Program protects the estimated water demand of AWS determinations, including groundwater and stored water to be recovered outside the area of impact, from being considered physically available to subsequent AWS applicants.

The Recharge Program criteria also link future use benefits to determinations under the AWS Program. If the recovery will occur outside the area of impact of storage, but the storage contributed to groundwater supplies that have been committed to establish an AWS determination[12], the recovery is deemed to be consistent with the management plan and achievement of the management goal. If recovery is to take place outside the area of impact, but is not contributing to groundwater supplies of an AWS determination, the recovery may still be consistent with the management plan and achievement of the management goal if the storage contributes to groundwater supplies accessible to current groundwater users, is a component of a remedial action project, or is otherwise determined by the Director to have contributed to the objectives of this chapter or achievement of the management goal. If a storage facility is found not to meet these criteria, the permit will include a notice to potential water storers that recovery of the stored water will be allowed only within the area of impact of storage until such time that the Director determines there is a demand for groundwater within the area of impact of the storage.

The requirement that recovery outside the area of impact of storage must be consistent with the PAMA's management plan and management goal continues to be a requirement even after the recovery well permit has been issued. Thus, previously permitted recovery wells are subject to the criteria of the 4MP and future management plans.

8.6.3 Criteria for Storage of Non-Recoverable Water

Pursuant to A.R.S. § 45-833.01(A),

> At the request of the applicant, the Director may designate a water storage permit as storing non-recoverable water. If the water storage occurs within an active management area, the water storage permit may be designated in this manner only if the storage is consistent with the active management area's augmentation program."

This designation has only been applicable in a few instances. In the second management period, non-recoverable storage occurred in association with certain augmentation grants that included storage of water to test the hydrologic feasibility of a recharge site. Under the 4MP, non-recoverable water storage may also occur as a result of an enforcement action associated with non-compliance of conservation requirements (see Chapter 10). For example, an entity out of compliance with its conservation requirements may agree to store water and extinguish any credits from that storage that might have otherwise accrued in the entity's long-term storage account of an equal volume to the volume of groundwater used in excess of the conservation requirement.

Water that is stored under a permit with this designation may not be recovered on an annual basis, may not be credited to a long-term storage account, and may not be used for replenishment purposes associated with a groundwater replenishment district. The same criteria for recovery and storage locations in the previous section exist for siting non-recoverable storage.

8.7 REGULATORY INCENTIVES

Provisions established in the Agricultural, Municipal, and Industrial Conservation Programs of this management plan provide incentives for water users to utilize renewable resources. The programs to

[12] Such as a Designation, Certificate, or Analysis of AWS.

increase the use of renewable water supplies are not alternatives to conservation. All water use should be as efficient as possible.

Shortages are anticipated on the Colorado River system in the coming years. The Code (particularly through the AWS provisions) and the management plans require a long-term perspective on supply and demand. In the long-term, efficient use of *all* water supplies is necessary.

Achievement of water management goals over the long term is only possible in the context of serious, long-term conservation efforts and increased utilization of renewable supplies. The focus should not be a debate between conservation and augmentation, but rather, efficiently using water. Matching the water resources to the most appropriate demand will continue to require sophisticated management of groundwater, surface water, and reclaimed water.

Incentives should be limited to applications where the desired response, such as substitution of use of renewable supplies for groundwater use or improved water conservation, would not otherwise have happened without the incentive.

Table 8-7 lists the 4MP incentives to use alternative supplies. Some of these incentives were established in the Second Management Plan. Because many of these incentives encourage use of alternative supplies at the expense of conservation, the augmentation incentives may need to be scaled back in the future in order to achieve the PAMA water management goal.

Although there may be a need to include specialized incentives to address sub-regional water declines, currently the only regulatory tool available to address these localized declines is to limit the recovery of recharged water in those areas, if it is recovered outside the area of impact of the stored water. Additional water management tools may need to be developed to help address this challenge in the future. The requirements described in Table 8-7 are designed to encourage direct use of reclaimed water rather than storage and recovery of reclaimed water.

TABLE 8-7
RENEWABLE WATER SUPPLY UTILIZATION INCENTIVES

Sector	Incentive
Municipal	Delivery of reclaimed water by a municipal water provider does not count against the gallons per capita per day (GPCD) requirement, unless it is reclaimed water that is stored in one location and recovered outside the area of impact. This is an incentive for municipal providers to invest in reclaimed water systems *(Chapter 5, section 5-703.A).*
Industrial	Reclaimed water use is discounted when calculating compliance with the annual allotment for a turf-related facility. For the 4MP, ADWR has retained the 30 percent discount that was included in the 3MP for the PAMA *(Chapter 6, section 6-1704.A).*
Industrial	Cooling towers that beneficially reuse 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements *(Chapter 6, section 6-2102.B).* Cooling towers that convert to at least 50 percent reclaimed water are exempt from the blowdown concentration requirements for one full year. If it is shown that they cannot meet the requirements, amended blowdown concentration levels may be applied (Chapter 6, section 6-2102.B.2).
Industrial	Large-scale power plants that recycle 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements *(Chapter 6, section 6-1902.C and 6-1903.B).*

Sector	Incentive
Agricultural	Pursuant to A.R.S. § 45- 467, reclaimed water use cannot contribute to a farm exceeding its allotment in any year. In determining whether a farm exceeds its maximum annual groundwater allotment for a year, total water use, including groundwater, reclaimed water, and surface water, is counted and any reclaimed water used that year is subtracted from the amount of groundwater that otherwise would have exceeded the farm's allotment.

Additional incentives to encourage use of remediated groundwater in lieu of high quality supplies are provided in the AWS Rules and through legislative requirements in the Water Quality Assurance Revolving Fund (WQARF) Program *(See Chapter 7)*.

8.7.1 Other Strategies to Address Water Management Challenges

As described in Chapter 2 and summarized in the physical assessment section of this chapter, certain areas within the PAMA are experiencing localized groundwater declines. These areas could continue to experience local declines even if groundwater pumping is reduced in the PAMA overall. A more localized approach to water management to address these areas could help offset these conditions. Therefore, ADWR will work to develop strategies to address the problems. Working cooperatively with stakeholders, ADWR's efforts may include: (1) developing local/state partnerships; (2) identifying areas of concern; (3) conducting hydrogeologic investigations as necessary; (4) examining new legislation and/or local ordinances; (5) developing programs; and (6) creating incentives that discourage or mitigate local water level declines.

8.8 CONCLUSION

There are a number of issues that can be addressed in order to facilitate achievement of the PAMA water management goal and other objectives discussed in this chapter. There is a growing recognition that the regulatory and non-regulatory tools that are available may not be sufficient to meet the PAMA water management objectives. As has been discussed, there are numerous factors that impact water use patterns, many of which are not regulated by ADWR. Although some Code provisions are directly linked to achieving the water management goal, there are many ways in which water management tools could be improved. An evaluation of the roles and responsibilities of all groundwater users in reducing groundwater mining will be initiated as described in Chapter 12. A key consideration in evaluating the need for stronger regulatory programs is whether economic conditions alone can substantially reduce groundwater use across all sectors. If all sectors reduce their groundwater pumpage substantially, the need to offset their groundwater pumpage will diminish.

Multiple strategies will continue to be considered during the fourth management period to attempt to achieve the PAMA goal and address water management challenges in specific geographic areas of the PAMA as the need arises. Many of these efforts will need to be undertaken in a cooperative approach with local stakeholders. Potential issues associated with groundwater pumping, such as large cones of depression, land subsidence, earth fissures, reduction in aquifer storage capacity, and the reduced physical availability of supplies may manifest themselves. The efforts to address these issues will require partnerships with PAMA entities that are willing to make necessary changes, and support efforts to improve groundwater conditions.

8.9 AUGMENTATION AND RECHARGE REQUIREMENTS

8-901. Storage and Recovery Siting Criteria

During the fourth management period, for the purposes of A.R.S. § 45 834.01(A)(2), recovery of stored water at a location is consistent with the management plan and achievement of the management goal for the active management area:

A. If recovery will occur within the area of impact of the stored water, regardless of whether the recovery well permit applicant was the storer of the water; or

B. If recovery will occur outside of the area of impact of the stored water, all of the following three criteria are met:

1. The water storage that resulted in the right to recover water:

a. Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or

b. Is a component of a remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or

c. Is otherwise determined by the Director to have contributed to the objectives of this chapter or the achievement of the management goal for the active management area.

2. Either:

a. At the time of the application, the maximum projected depth to water at the location of the recovery well after 100 years does not exceed the general 100-year depth-to-static water level for the active management area specified by A.A.C. R12-15-716 after considering: (1) the maximum proposed withdrawals from the recovery well; (2) withdrawals for current, committed, and projected demands associated with determinations made under A.R.S. § 45-576 that are reliant on the water which the recovery well will withdraw; and (3) withdrawals for other current or projected demands that are reliant on the water which the recovery well will withdraw; or

b. The recovery will be undertaken within the applicant's service area and the applicant is a municipal provider designated as having an assured water supply.

3. The recovery well is:

a. Located in an area experiencing an average annual rate of decline that is less than 4.0 feet per year; or *b. A component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

c. Likely to contribute to the water management objectives of the geographic area in which the well is located, as determined by the Director.

8-902 Storage of Non-Recoverable Water

During the fourth management period, water storage that is designated as non-recoverable is consistent with the active management area's Recharge Program if one of the following criteria is met:

The water storage:

1. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

2. *Is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, except projects for which groundwater is withdrawn to provide an alternative water supply pursuant to A.R.S. § 49-282.03, and the Director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

3. *Is otherwise determined by the Director to contribute to the objectives of this chapter or the achievement of the management goal for the active management area.*

APPENDIX 8
DECLINE RATE METHODOLOGY

In evaluating an application for a proposed recovery well permit, ADWR considers many factors in determining consistency with the average water level decline rate siting criteria. The time frame for which the average is calculated may vary based on data availability and the hydrologic characteristics of the area. Major trends in precipitation, water supply utilization over time, hydrogeologic data, and the modeling of projected impacts may be factors in evaluating this rate. Other considerations may also be appropriate depending on the location of the proposed recovery well.

Typically, ADWR examines the historic static water level data for the period of record for wells located in the section in which the proposed recovery well is located and in the eight sections that surround the section where the proposed well is located. The specific area examined depends on the availability and quality of water level data and the hydrogeology of the area. Bedrock outcrops, large pumping centers, and other features may affect the determination of pertinent data. Generally, wells that are screened in the aquifer of concern and regularly monitored using consistent methods for static water level data are good reference points (such as ADWR's statewide monitoring or index wells). ADWR examines the well hydrographs (graphs of static water levels over time), and evaluates the slope of the curve for the period of interest. The slope indicates whether the static water level in the monitoring well has risen or fallen over time. A horizontal line on the hydrograph indicates that water levels remained stable over time. ADWR identifies what activities may have caused the groundwater changes over time to see whether the activity still exists or has been reduced, eliminated, or increased over time.

This approach provides more flexibility and protection of the groundwater resource than would be provided by a simplistic evaluation of decline rates calculated for all water level data within a set radius and during the entire period of record. For example, if a recovery well is proposed for an area which historically had a rapid decline in groundwater levels due to activities that no longer exist (e.g., retirement of agriculture after heavy agricultural use in the 1940s and 1950s), and if the proposed area is not at high risk for land subsidence, the proposed recovery well might be deemed consistent with the average decline rate criteria by looking at the period of time after the historic change in use. Similarly, if water levels in the vicinity of the proposed recovery well were stable for decades, but recently a new use caused rapid rates of decline, the proposed recovery well may be deemed inconsistent with the criteria.

ADWR's groundwater models may be used to project future water levels and decline rates on a regional basis. Modeling may assist the permittee in evaluating recovery options. Where there are sufficient data, a model may give an indication of how long recovery within a region may remain permitted based on the current average decline rate criteria.

The most current procedures for establishing the average groundwater level decline rate in the vicinity of a proposed recovery well will be published in ADWR's Recovery Well Application Packet, however the general procedure is described below.

Decline Rate Procedure Description

To evaluate the four-foot decline criteria, ADWR will review water level data from all available, reliable sources of water level data in the vicinity of the proposed recovery well. Some sources include the ADWR Groundwater Site Inventory (GWSI) database, water levels submitted with the recovery well application from the applicant, or other water level data available.

The entire period of record for each well in the vicinity of the proposed recovery well is plotted on a hydrograph. The entire period of record of measurements is often used in the evaluation; however, sometimes the hydrograph reveals a pronounced inflection in average slope of the hydrograph, indicating that the entire period of record may not be representative of current conditions. The inflection may be attributed to conditions such as urbanization of previously irrigated acreage or the introduction of a new water source. The latest portion of the hydrograph that is most representative of current conditions, and will likely continue in the future, is then used in the analysis.

The average annual rate of decline for a given well is calculated by dividing the total change in water level for the selected period of record by the period of record, in years. The water level change for each well is averaged to arrive at an average water level change in the vicinity of the proposed recovery well. Care is taken to select wells for averaging near the proposed recovery well that are representative of nearby aquifer conditions.

Bibliography

ADWR. (2010). *Arizona Water Atlas: Volume 1, Executive Summary* . Phoenix: Department of Water Resources.